2813#19
12/30/02
Mollish

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: Ravi Iyer

Serial No.: 09/059,865

Filed: April 14, 1998

For: PLANARIZATION USING PLASMA OXIDIZED AMORPHOUS SILICON

Group Art Unit: 2813

Examiner: Nguyen, T.

Atty Docket: MICS:0015--2/FLE 93-118.02

Assistant Commissioner
for Patents
Washington, D.C. 20231

Sir:

REQUEST FOR REHEARING UNDER TO 37 C.F.R. § 1.197(b)

In response to the Decision on Appeal mailed on September 25, 2002, for the above-referenced application, Appellant respectfully requests rehearing of the Board's Decision in view of the remarks set forth below.

"Stringers" Must Be Defined Consistently

Upon review of the Decision on Appeal, it does not appear that the Board defined the term "stringers" consistently. Specifically, when considering the Section 112 rejection, be Board appeared to define "stringers" as "undesirable residual non-dielectric material" left after removing the non-dielectric material from the protruding features. In contrast, when considering the Section 103 rejection, the Board appeared to define

"stringers" as "a line-shaped residue of a polysilicon or amorphous silicon material after a removal process." As discussed below, this inconsistency cannot stand, and the Board's first definition is correct.

In its Decision on Appeal, the Board first addressed the rejection of claims 18-23 under 35 U.S.C. § 112, first paragraph. The Board considered the specification to determine whether it supported Appellant's contention that one skilled in the art of semiconductor fabrication would understand that the claimed stringer or residue is "undesirable." As set forth in the description of an embodiment in the specification, a layer 602 may be deposited over protruding device features 601. Page 13, lines 20-22. The layer 602 may be polysilicon or amorphous silicon, for example. Page 13, lines 22-24. The specification goes on to state that "layer 602 is patterned and etched to clear areas where layer 602 is *not needed*." Page 13, lines 24-27 (emphasis added).

In finding that the specification supports the recitation of "undesirable residual non-dielectric material" found in claim 18, the Board noted that page 13, line 29, through page 14, line 2, of the specification describes "the formation of non-dielectric stringers or residue (701) which result from the removal process." The Board recognized that these "stringers" are difficult to remove without damaging the structure or topology of the protruding features. Page 13, line 29, to page 14, line 2. The Board also correctly noted that the specification goes on to describe these stringers as being undesirable because they cause problems, such as gate leakage for example.

In conclusion, in addressing the Section 112 rejection, the Board held that the specification defined the term "stringer" as "undesirable residual non-dielectric material" left after removing non-dielectric material from the protruding features. In other words, a "stringer" is "undesirable residual non-dielectric material" that ideally would have been removed during the normal removal process, and its presence is *not needed* and could result in undesirable problems.

Given this definition, the Board's treatment of the term "stringer" when considering the Section 103 rejection was somewhat surprising. In considering the Section 103 rejection, the Board correctly noted that the claims must be interpreted as broadly as their terms "reasonably" allow. The court correctly cited the case of *In Re Zletz*, which states that the words of the claim must be given their "plain meaning" unless the Applicant has provided a clear definition in the specification. *In Re Zletz*, 13 U.S.P.Q.2d 1320, 1322 (Fed. Cir. 1989).

However, what the Board may have overlooked is that "plain meaning" refers to the meaning given to the term *by those of ordinary skill in the art*. M.P.E.P. § 2111.01. Accordingly, unless those of ordinary skill in the art of semiconductor fabrication routinely use common, non-technical, public dictionaries, such as Merriam-Webster's Collegiate Dictionary, to define terms used in the art, the use of such a dictionary would generally be antithetical to the requirement of determining "plain meaning" of a claimed term as understood by those of ordinary skill in the art of semiconductor fabrication. Nevertheless, the Board referred to Webster's Dictionary in an effort to find a definition

of the term "stringer." Not only did Webster's Dictionary utterly fail to offer an accurate definition of the term "stringer" as used by those skilled in the art of semiconductor fabrication, Appellant respectfully submits that the Board improperly found that Webster's Dictionary defined a "stringer" as a "string." Indeed, a review of the definition provided with the Decision on Appeal reveals that the term "stringer" is defined as "a string...*with snaps on which fish are strung by a fisherman*." (Emphasis added). It appears that the Board completely and improperly ignored the very important words that came after the word "string." Appellant trusts that no evidence is required to demonstrate that those skilled in the art of semiconductor fabrication would never consider the term "stringer" to mean "a string with snaps on which fish are strung by a fisherman" unless they were going fishing.

The Board then turned to the specification and found that it defines "stringers as 'a residue' of a polysilicon or amorphous silicon left after the removal process." This is quite surprising because the Board had already determined that the present specification defines a "stringer" as "*undesirable* residual non-dielectric material" left over from the unsuccessful removal of a layer of material. (Emphasis added). Specifically, when considering the definition "stringers" under the Section 112 rejection, the Board stated that the specification would "convey with reasonable clarity to one skilled in the art that the stringers are *undesirable* residual non-dielectric material left after removing non-dielectric material from the creases adjacent the protruding features." However, when considering the definition of "stringers" under the Section 103 rejection, the Board

inconsistently found the term "stringers" to be merely "a residue" instead of "an undesirable residue" even though the Board was relying on the *same specification*.

To address the "undesirability" of stringers, the Board then stated that Appellant's definition of "stringers" as a term of art for "small, undesirable residuals that are typically left in creases on a substrate after an etching process" as unpersuasive because Appellant failed to provide any authority for this definition and because a search for the definition of stringers in specialty dictionaries did not produce any guidance. Accordingly, the Board held that "stringers" are "a line-shaped residue of a polysilicon or amorphous silicon material after a removal process."

Appellant did not believe it was necessary to produce any extrinsic authority, because Appellant was relying on the definition of the term "stringers" as set forth by a reasonable reading of the specification by one of ordinary skill in the art of semiconductor fabrication. Indeed, the Board reached essentially the same definition as Appellant in the Board's analysis of the Section 112 rejection. Furthermore, it is not surprising that specialty dictionaries to do provide a specific definition of the term "stringer" because it relates to only one of literally thousands of problems and processes related to semiconductor fabrication.

The above notwithstanding, Appellant respectfully directs the Board's attention to page 22 of *Plasma Processing of Materials: Scientific Opportunities and Technological Challenges* (1991), which illustrates a polysilicon "stringer" and discusses the problem of damaging the gate structure if the silicide and polysilicon layers must be over-etched to remove the stringer residue. Exhibit 1. In other words, this prior document describes the undesirable residual non-dielectric material and the problems associated with such residue in the same manner and using the same terms as the present application. Accordingly, it provides much better evidence than Webster's Dictionary of the manner in which one of ordinary skill in the art of semiconductor fabrication would understand the meaning of the term" stringer."

In conclusion, Appellant respectfully requests that the Board hold that the term "stringer" means "undesirable residual non-dielectric material" in accordance with the specification and in accordance with the manner in which the term is commonly understood by those of ordinary skill in the art of semiconductor fabrication.

"Spacers" Are Not "Stringers"

The Board then addressed the disclosure of the Kim reference. The Board stated that "Kim discloses the step of removing a portion of the layer of non-dielectric material, leaving 'stringers' of the non-dielectric material in the creases." The Board alleged that "Kim has used the word, 'spacers' to describe what Appellant recites as 'stringers.'" The Board ultimately found that the Kim reference disclosed the claimed subject matter of both independent claims 12 and 18.

To reach this conclusion, the Board addressed Appellant's argument that stringers are different than spacers because stringers are undesirable residuals while spacers are desirable structures. While the Board apparently recognizes that spacers have some advantages that make them desirable, the Board further noted that spacers may have some disadvantages that make them undesirable. In regard to the Kim reference particularly, the Board noted that the silicon spacer 18 has some advantages that make it desirable. However, the Board concluded that it is the thermal oxide spacer 19, not the silicon spacer 18, that is ultimately desirable, thus meaning that the silicon spacer 18 is "undesirable residual non-dielectric material in some of the creases." Hence, the Board sustained the Examiner's rejection.

Appellant respectfully traverses the Board's decision in this regard. It is certainly true that the silicon spacer 18 has some advantages that make it desirable. The Kim reference clearly discloses a method in which the spacer 18 is purposely formed using "common spacer-forming methods." Col. 2, lines 51-61. Anything purposely formed must be desirable, otherwise it would not be formed on purpose. Appellant respectfully submits that the silicon spacer 18 is desirable and necessary. Indeed, in the first embodiment of Fig. 1, the silicon spacer 18 is *actually present* in the final device and used to fill part of the contact hole. Even in the second embodiment of Fig. 2, if it were not for the silicon spacer 18, the thermal oxide spacer 19 could not be formed. Hence, in both situations, it appears that the silicon spacer 18 is purposely created, useful, desirable, and necessary for the successful implementation of the Kim device.

Furthermore, the Board damns the silicon spacer 18 as being "undesirable" without any reference in the Kim patent to that effect. The Kim reference never once mentions that the silicon spacer 18 is undesirable, never once mentions that the silicon spacer 18 would cause any type of problem, and never once mentions that the silicon spacer 18 is an accidental or undesirable residual that preferably would have been removed along with the rest of the silicon coating layer. Thus, the Kim reference stands in stark contrast to the instant application, which the Board has already recognized as disclosing the undesirability of the "undesirable residual non-dielectric material" known by those skilled in the art as "stringers."

It is eminently clear from a review of the Kim reference that the spacers 18 and 19 are purposely fabricated for a particular use. In sharp contrast, the stringers or undesirable residue set forth in the present claims are always undesirable and serve no useful purpose whatsoever. Indeed, as described in the present application, if the layer of material 602 could be removed so as not to leave residue or stringers 701 and so as not to damage the underlying structures, it would be!

In conclusion, Appellant respectfully requests the Board to reconsider its interpretation of the Kim reference vis-à-vis the present claims. Specifically, Appellant respectfully requests that the Board find that spacers are desirable and purposely-created structures in contrast to stringers that are undesirable and accidentally-created residues. Accordingly, Appellant respectfully requests that the Board find that claims 12-23 distinguish over the Kim reference and the other prior art of record.

If any fee is currently due, the Commissioner is authorized to charge any fees which may be required to Deposit Account No. 13-3092; Order No. MICS:0015--2/FLE (93-118.02).

Respectfully submitted,

Date: November 25, 2002

Michael G. Fletcher
Reg. No. 32,777
FLETCHER, YODER & VAN SOMEREN
P.O. Box 692289
Houston, TX 77269-2289
(281) 970-4545

EXHIBIT 1

Plasma Processing of Materials: Scientific Opportunities and Technological Challenges (1991)

Commission on Physical Sciences, Mathematics, and Applications (more titles from CPSMA)

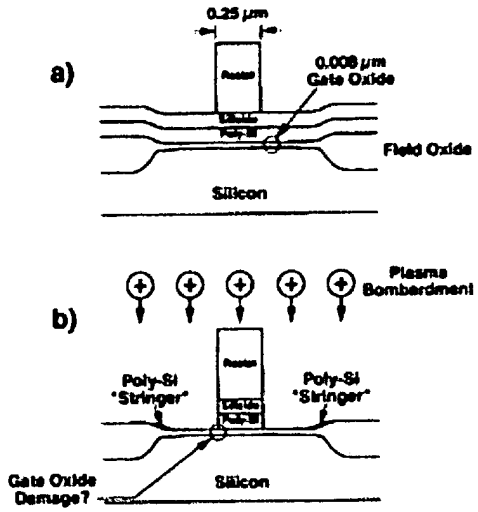

Figure 3.12 Schematic illustration of 0.25-μm polysilicon/silicide gate structure used in metal-oxide-semiconductor field-effect transistors (a) before and (b) after anisotropic plasma etching. The gate oxide is only 80 angstroms thick and very sensitive to plasma-induced damage. Without planar geometry, over-etching is required to remove polysilicon "stringers" near the field oxide isolating layer. (Adapted from J. M. Cook and K. G. Donohoe, 1991, "Etching Issues at 0.35 μm and Below," *Solid State Technol.* 34, 119. Reprinted with the permission of *Solid State Technology*.)

Selectivity

Material-selective etching is crucial for avoiding linewidth loss: ideally, the photoresist mask should not etch at all while the underlying film is being patterned. Similarly, after the film has been etched, the plasma ideally should not etch or alter the properties of the underlying thin film. Today, we do not understand the fundamental limits to selective etching in plasmas, but we do know that selectivity depends on both chemistry and charged particle bombardment. The same energetic bombardment that provides anisotropy in plasma etching tends to reduce selectivity, and a major challenge for the future will be to understand fundamental limits to both anisotropy and uniformity as a function of energetic particle bombardment.

We do know that the selectivities we can achieve today are inadequate for fabricating the devices of tomorrow. For example, aluminum can be etched typically 2 to 4 times faster than photoresist today. In just a few years, we will need to etch aluminum at least 10 times faster than photoresist to meet linewidth-loss specifications. The ability, which we currently do not possess, to selectively etch similar materials (silicon nitride with respect to silicon dioxide; polysilicon with respect to metal silicides; silicon with respect to germanium) will create opportunities for low-cost, large-volume, fabrication of new, high-performance electronic devices.

Material selectivity in plasma etching is most demanding in etching gates for metal oxide semiconductor field-effect transistors (MOSFETs) where the gate oxide thickness will be less than 10 nanometers as device dimensions shrink. Consider the structure shown in Figure 3.12. Because of the topography, the silicide and poly-silicon layers must be over-etched to remove the "stringer" residue at the edge of the device, and selectivities for etching silicon or metal silicides with respect to silicon dioxide will have to be greater than 50 to 1 to maintain high yields.

Uniformity

Uniformity across a wafer must be maintained so that the underlying materials are not subjected to extended plasma exposure. The degree of uniformity required, therefore, depends